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24 February 1987  
Vol. 2, No. 3

# **Science and Technology Perspectives**

## **DEVELOPMENTS**

### **Robotics**

(Japan) The Electrotechnical Laboratory of the Agency of Industrial Science and Technology has successfully tested a prototype manipulator that combines the functions of a "force" sensor and a visual motion cell. Able to place fragile objects into small holes, the manipulator has a distortion gage which enhances its position and tactile control beyond that of current manipulators. The project is part of an effort to develop a robot with tactile abilities resembling those of a human. (NIKKAN KOGYO SHIMBUN 17 Dec 86) Akiko S. X2726

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## **FEATURE ARTICLES**

### **JAPAN/WEST EUROPE: High Definition Television ..... Page 4**

Japan and West Europe are vying for the lead in the development of a high definition television (HDTV) system.

### **USSR: Organic Solids as Conductors ..... Page 6**

Soviet scientists are conducting research on "organic metals" to determine their potential use in computer and electronic components.

### **USSR: Laser Findings Challenge Measurement Standards ..... Page 8**

Soviet researchers claim that laser frequencies used as measuring constants decrease over time.

## **REPORTS**

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PERSPECTIVES selections are based solely on the foreign press, books and journals, or radio and television broadcasts. Some of the materials used in this publication will appear as abstracts or translations in FBIS serial reports. Comments and queries regarding this publication may be directed to the Managing Editor (Craig M. ) or to individuals at the numbers listed with items.

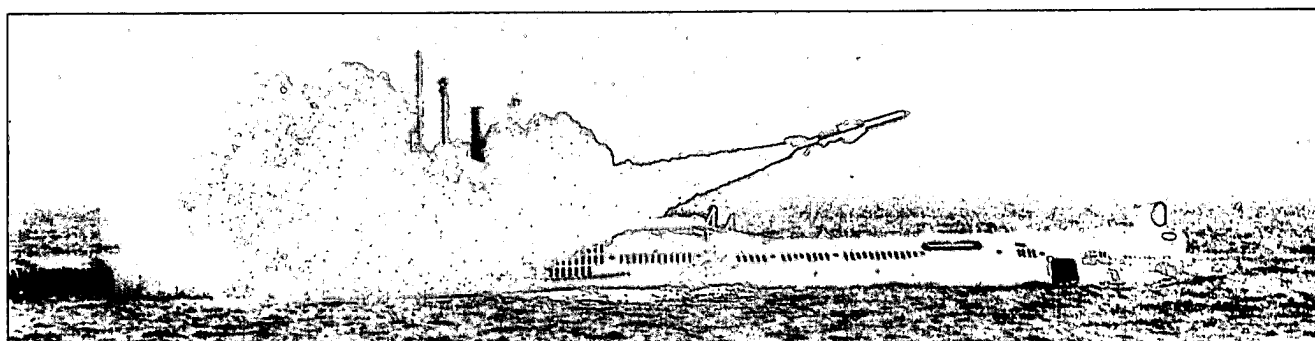
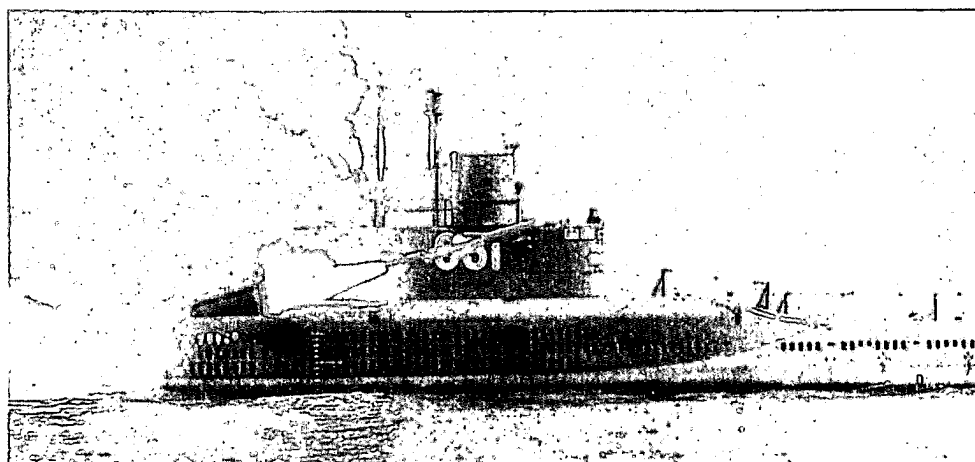
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*DEVELOPMENTS highlights worldwide S&T events reported in the foreign media. Items followed by an asterisk will be published by FBIS. The contributor's name and telephone number are provided.*

**Antiship Missile**

(PRC) The Chinese have completed launch testing of the C801 multipurpose antiship missile produced by the China Precision Machinery Import and Export Corporation. The basic model is a coastal defense missile system which includes tracking radar, firing command instrumentation, launch cannisters, road transport vehicles, and comprehensive diagnostic equipment. The PRC also has a shipborne and an airborne version (without rear booster). The photos below show the submarine-launched C801. Its launch platform is a modified Romeo-class conventional submarine, capable of surface launches only. (Hong Kong HSIENTAI CHUNSHIH No. 122, 1 Jan 87) Henry V. X2779



*The Chinese C801 Antiship Missile*

**Aircraft Diagnostics**

(USSR) The Soviets have reported four new diagnostic systems for evaluating aircraft performance: Analiz-86, which is used to evaluate NK-86 engines; Kontrol NK-8-2U (no details given); Poisk, which transmits a numerically coded malfunction signal from the aircraft to a ground-based troubleshooting

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computer; and Nadezhnost, which uses an Iskra-226 minicomputer to analyze aircraft performance data stored on a magnetic tape. (Moscow VOZDUSHNYY TRANSPORT Nov 86) Irene A. X 2723

**Electronics**

(USSR) The Soviets are developing a solid-state magnetic bubble memory (MBM) "superchip" (also referred to as the "vertical Bloch-line circuit"). Although start-up costs for bubble memory technology are high, the manufacturing process is less complex than that involved in semiconductor circuitry. MBM technology would help the Soviets compensate for deficiencies in their production of mass memory systems. Institutes conducting this research include the Moscow Institute of Electronic Technology and the Institute of Control Problems. (Moscow MIKROELEKTRONIKA Vol. 1, Nos. 1 and 4, 86)\* Irene A. X2725

(FRG) Siemens is investing 100,000 ECU to build a production line for so-called "10K-array" bipolar chips (not further described). The technology for these chips, which have a 200-picosecond access time, is a direct spinoff of ESPRIT research. Prototype development is planned for 1987. (Brussels EEC INFORMATION MEMO No. P-98 Dec 86)\* Antwerp Unit/Sharon W. X2519

(France) The National Center for Telecommunications Studies (CNET) has developed a "molecular semiconductor" by synthesizing lutetium diphtalocyanine. The material has semiconductor properties and can be used to create junction and field-effect transistors (FETs). Lutetium diphtalocyanine, which is synthesized by the Protex company, is being studied jointly by CNET, the Paris Ecole Superieure de Physique et Chimie, and the Claude Bernard University in Lyons. (Paris CPE FLASH 1 Dec 86) Antwerp Unit/Sharon W. X2519

(PRC) Scientists at the Institute of Physics of the Chinese Academy of Sciences reportedly have discovered a metal oxide that allows superconductivity at 70°K, the highest temperature ever recorded. The new metal oxide is composed of barium, lanthanum, copper, oxygen, and other elements (not further identified). To date, 98°K has been the highest temperature at which superconductivity has been achieved. (Beijing RENMIN RIBAO 27 Dec 86) Joe A. X2726

**Lasers**

(PRC) The Chinese Academy of Sciences' Fujian Institute on the Structure of Matter has developed high quality barium borate crystals, essential for laser spectroscopy in medicine and biochemistry. The development of these nonlinear optical crystals, after a research effort of 11 years, reportedly puts the PRC ahead of the West in this technology. (Beijing GUANGMING RIBAO 8 Nov 86) Joe A. X2726

(Israel) The Weizmann Institute and the Israeli firm Elop have developed a neodymium-YAG laser whose optical pumping is solar powered. The laser, which has applications in space communications systems, generates 100 watts of power (twice that of other solar lasers). (Paris CPE FLASH 15 Dec 86) Antwerp Unit/Sharon W. X2519

**Machine Tools**

(USSR/Bulgaria) A third Soviet-Bulgarian Science and Production Association for machine tools was established on 14 November by the Pobeda Machine Tool Combine in Sliven, Bulgaria and the Moscow

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Machine-Building Association for Automatic Lines and Special Machine Tools. The new association, which is yet to be officially titled, will design and produce equipment for machining rotary parts for automobiles and agricultural equipment. The two other associations are Ivanovo-ZMM and Krasniy Proletariy-Beroe. (Sofia RABOTNICHESKO DELO 15 Nov 86) Rita S. X2609

**Nuclear Submarine**

(PRC) China's Xia-class submarine recently completed its first "long-range" training cruise. The nuclear-powered vessel, which was designed and built entirely by the Chinese, set PRC Navy records (specific figures not given) for time submerged, distance traveled, and average cruising speed. The submarine reportedly is now on active duty. (Beijing RENMIN RIBAO 1 Jan 87)\* Joe A. X2726

**Plasma Research**

(Poland/GDR) The Aviation Institute in Warsaw, in cooperation with the GDR Academy of Sciences, is building an improved plasma wave analyzer for the Phobos mission scheduled for early 1989. The device will be used to study plasma around Mars and its nearest moon. The analyzer also will be used to take plasma measurements during the seven-month flight to Mars. (East Berlin URANIA No. 10, Oct 86) Rita S. X2609

(PRC) The HT-6M tokamak, designed and built by the Institute of Plasma Physics (IPP) of the Chinese Academy of Sciences, was successfully tested in December 1986. Built in 1984, the device is being used to study the composition, motion, and high-power microwave properties of plasma. IPP experts believe that as a tool for comprehensive physics research, the HT-6M is comparable to similar Western devices. The PRC also plans to develop a mixed fission-fusion reactor. (Beijing RENMIN RIBAO 10 Jan 86) Joe A. X2726

**Underwater Robot**

(PRC) Using technology licensed from the US firm Perry Offshore Inc., the PRC has developed its first underwater robot, the HR-01. Intended for use in oil exploration and dam construction, the 2.5-ton robot was tested successfully at a depth of 199 meters in the South China Sea. The HR-01 will be manufactured by the Shenyang Institute of Automation under an agreement with Perry Offshore. The Chinese plan to export the robot by 1988. (Beijing XINHUA 20 Dec 86; Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT 10 Dec 86) Joe A. X2726

**FOR OFFICIAL USE ONLY****JAPAN/WEST EUROPE: HIGH DEFINITION TELEVISION**

*Key Points: While West Europe evaluates proposals for high definition television (HDTV) systems, Japan has already tested a prototype HDTV system and started manufacturing compatible equipment. However, the final decision on a worldwide HDTV equipment and transmission standard will not be made until 1990, according to recent West European press reports.*

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**Progress in Japan**

The Japanese have taken the lead over their West European competitors in the development and testing of an HDTV system. The Nippon Hoso Kyokai (NHK/Japanese Public Broadcasting Company) has developed a prototype MUSE (Multiple Sub-Nyquist Sampling Encoding) HDTV system while Japanese electronics firms (not further identified) have begun producing MUSE-compatible equipment. The Japanese hope to edge out their West European counterparts in gaining CCIR (International Telecommunications Consultative Committee) approval for their HDTV standard. Although the CCIR will not make its decision until 1990, the Japanese are positioning themselves to assume international leadership in the HDTV market.

The Japanese MUSE system is based on vertical and horizontal subsamplings of the original HDTV signal and operates at 1125/60/2:1 (with 1125 representing the number of screen lines; 60 the frequency in Hz; and 2:1 indicating interlaced scanning). MUSE's low carrier-to-noise ratio allows a large volume of information to be carried in a given bandwidth—a prerequisite for HDTV. The MUSE signal can be compressed into an 8.1 MHz bandwidth for transmission over a single satellite channel allocated by the World Administrative Radio Conference (WARC). Tests in 1986 at the RAI (Italian Radio and Television) Research Center in Turin showed that the MUSE system is virtually free of image distortion and exhibits excellent audio characteristics.

The Japanese have begun marketing MUSE production equipment (such as television cameras, film, and recorders) and have developed prototypes of the encoders and decoders for the transmission system.

**Problems in West Europe**

West European HDTV systems remain in the design phase because of the inability of European electronics firms to develop a system compatible with MAC (Multiplexed Analog Components) signal encoding standards to be used by the West German TV-Sat and the French TDF-1, the two direct broadcast satellites (DBS) whose coverage area will include almost all of West Europe. The MAC system also requires new and unique receiving equipment. Philips of the Netherlands proposes a MAC-compatible HDTV system that uses vertical and horizontal subsamplings of the original HDTV signal, as in MUSE. According to Philips, this system gives the desired bandwidth (narrow enough for a single satellite channel) and produces vertical resolution comparable to that of MUSE. Horizontal subsampling has not yet been assessed.

HDTV proposals from the French Telecommunications Authority (DGT) are encountering technical problems because of their requirement for two WARC-allocated satellite channels, thus giving the single-channel MUSE system the advantage.

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The DGT also proposes that the number of active image scanning lines be doubled in comparison to that of conventional television. The European Broadcasting Union, however, claims that at least 10 years would be required to produce equipment operating with this standard. The French proposal would also retain the 50 Hz frequency standard currently used in Europe, complicating efforts to achieve international compatibility.

Additional West European research based on the 50 Hz standard is being conducted within the framework of EUREKA, which has allocated 180 million ECUs through 1990 for an HDTV research project led by Philips, Thomson (France), Thorn-EMI (UK), and Bosch (FRG).

Milan Unit/Eva L. X2519

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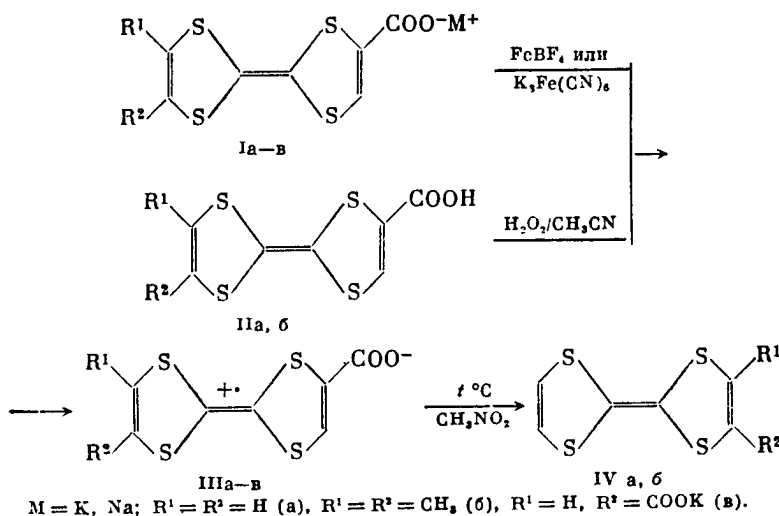
## USSR: ORGANIC SOLIDS AS CONDUCTORS

*Key Points: Chemists at the Riga Polytechnical Institute im. Ya. A. Pelshe and at the Institute of Chemical Physics (IKhF), Chernogolovka Branch, are conducting research on new organic solid compounds that act as semiconductors at very low temperatures and superconductors at higher temperatures. These so-called "organic metals" have potential applications in computer logic gates, high-field magnets, solar cells, and electronic components, according to ZHURNAL ORGANICHESKOY KHIMII (Nov 86) and IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA (Nov 86).*

Recent Soviet studies have shown that certain organic solids exhibit electrical, optical, or magnetic properties. Although most of these compounds are insulators, salts derived from tetrathiafulvalene exhibit semiconductivity at very low temperatures and superconductivity at higher temperatures. Intrinsic salts of tetrathiafulvalene carbonic acid cation-radicals are the primary focus of the Riga research, while IKhF chemists are studying tetrathiafulvalene cation-radical salts with tetrahedral anions.

The Riga group is attempting to produce an organic superconductor by oxidizing tetrathiafulvalene carbonic acids with ferrocenium tetrafluoroborate salt, potassium hexacyanoferrate salt, and hydrogen peroxide. The researchers claim that this approach is a prospective means of forming an organic metal crystal without an anion. As shown below, cation-radical and anion groups are contained in the same molecule in the final intrinsic cation-radical salt.

IKhF chemists have synthesized the organic conductor bis(ethylenedithio)tetrathiafulvalene tetraborate by oxidizing bis(ethylenedithio)tetrathiafulvalene (BEDT-TTF) with a copper borate salt. This compound has a conductivity of  $30 (\text{Ohm}\cdot\text{cm})^{-1}$  at room temperature and reaches maximum conductivity at 4°K.





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Organic solids exhibit conductive behavior because of a crystalline structure formed by a series of alternating "stacks." Metallic conduction is associated with "empty states" in bands of electrons that travel vertically along the stacks at rates determined by their thermal energy. Conductivity peaks at an average of 59°K for this group of solids, decreasing at higher temperatures as electrons become scattered by increased lattice vibration.

Kris P. X2898

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**USSR: LASER FINDINGS CHALLENGE MEASUREMENT STANDARDS**

*Key Points: Physicists at the All-Union Scientific Research Institute of Physical-Technical and Radioelectronic Measurements report that laser frequencies used as measuring constants decrease over time. These results call into question the reliability of current international standards used to determine measurements of length and distance, according to KHIMIYA I ZHIZN, No. 9 (Sep 86) and PISMA V ZHURNAL EKSPERIMENTALNOY I TEORETICHESKOY FIZIKI, Vol. 43, No. 4 (25 Feb 86).*

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The results of Soviet experiments over a period of some five years reportedly show that the frequencies of helium-neon lasers (used as an international standard to establish the length of a meter) decrease over time. The Soviets findings imply the unreliability of this standard as a precise unit of measurement for military, commercial, and scientific purposes. In 1983 the standard for the length of a meter (based on the transition between two specific energy levels of the Krypton-86 atom) was discarded as unsatisfactory for high precision aircraft and spacecraft navigation and missile guidance. The current standard for the meter, derived from the distance traveled by light in a vacuum during 1/299,792,458 seconds, was determined by frequency measurements using a helium-neon laser. International standards of measurement are expected to be reproducible in the laboratory and are assumed to be invariable. The Soviet tests, however, indicate that the meter as determined by this laser is increasing in length as the frequency upon which it is based decreases over time.

Soviet physicists conducted extensive laboratory testing to demonstrate that helium-neon lasers (stabilized to two different components of methane) decreased in frequency by more than 4 kHz over a 56-month period. First measured on April 1981, the laser frequency stabilized to the F component of methane measured 88,376,181,600.4 ( $\pm 0.5$ ) kHz while the second laser stabilized to the E component measured 88,373,149,033.3 ( $\pm 1.7$ ) kHz. Measurements of the two lasers in December 1985 gave readings of 88,376,181,595.7 ( $\pm 0.5$ ) kHz and 88,373,149,029 ( $\pm 0.07$ ) kHz—a decrease of 4.7 kHz and 4.3 kHz respectively.

A total of 3,000 frequency readings were taken over the 56-month period under strict laboratory conditions. After evaluating all stages of the study the Soviets concluded that no methodological error could account for the readings. Additional studies are now under way to investigate possible variances in other quantities assumed to be constant.

John H. X2723

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**REPORTS**

*REPORTS surveys science and technology trends as detailed in articles, books, and journals. It also includes summaries and listings of articles and books which may serve as potential sources for future research. Conference proceedings will occasionally be presented in this section.*

**HIGH-TECH MARKETS**

**FINLAND: MARKETING SOVIET COMPUTERS**

Finland's KITEC computer center, recently established in Kotka (near the Finnish-Soviet border), will market Soviet computers internationally, modify Soviet computers for applications in Western and Bloc industry, and act as an international consultant for the Soviet computer industry, according to December reporting in HUFVUDSTADSBLADET.

In collaboration with ELORG-DATA (which is jointly owned by the Soviets and the Finnish firms KOP, Nokia, and Teboil), KITEC plans to increase sales of Soviet computers to the West. According to center director Heikki Hallantie, KITEC will implement an international marketing strategy that will draw upon the firm's extensive knowledge of Soviet computer technology. Hallantie, however, emphasized Finland's dependence on US computer technology and stressed that KITEC's dealings with the Soviet Union in no way violate COCOM restrictions. As proof of KITEC's reliability, Hallantie noted that the US firm International Data Corporation has named KITEC as its agent for computer sales to CEMA countries.

Eighty percent of KITEC is controlled by the Finnish Government with the other 20 percent held by Finnish business organizations (not further identified).

Elli M. X2519

**CUBA/JAPAN: JOINT VENTURES WITH BRAZIL?**

Recent public statements by Cuban Government officials and Japanese businessmen indicate that Havana and Tokyo are each looking to establish joint ventures with Brazilian high-tech institutes and firms. The primary focus of this interest is in the Brazilian computer and electronics industry, according to recent reports in the Rio de Janeiro daily O GLOBO.

Last August a manager (not named) from Havana's National Institute of Automated and Technical Computer Systems visited Brazil to inquire about government policies regulating the country's computer industry. (For a discussion of Brazilian computer policies, see FB PN 86-144.) While in Brazil in late October to publicize a January 1987 Havana conference on computer applications in engineering and architecture, Marcel Andino Zayas of Cuba's Department of Scientific Research of the Jose Antonio Echeverria Superior Polytechnic Institute commented on Cuban interest in the Brazilian computer industry. Although neither Cuban official publicly raised the prospect of joint ventures, the August and October visits seem to signal preliminary efforts to approach the Brazilian computer industry.

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In separate discussions, Japan's Toshiba International wants to establish joint ventures with Brazilian computer and factory automation firms, according to company president Nobuyoshi Mori. Toshiba is also considering joint ventures in electronics, telecommunications, fine ceramics, and biotechnology. In a comment apparently aimed at softening Brazilian protectionist attitudes and at offering a quid pro quo arrangement for Japanese high-tech products, K. Inada Technology president Koichi Inada recently stated that Japan offers the best growth potential for Brazilian exports such as aluminum, steel, and steel alloys.

Nate D. X2676

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## **USSR: NEW PUBLICATIONS**

### **OCEANOGRAPHIC RESEARCH AND OCEAN SENSING**

The 1986 book "Works of the General Physics Institute, Vol. 1: Remote Sensing of the Ocean" (Trudy Iofan, Vol. 1: distantсионnoye zondirovaniye okeana) edited by A.M. Prokhorov contains papers on laser measurements of the upper ocean, radar study of the nonlinear dynamics of surface waves, and laser generation of sound in liquids.

A translation has been published as USSR REPORT: EARTH SCIENCES (UES-86-029-L).

The 1983 book "Remote Methods of Measuring Oceanographic Parameters" (Nekontaknyye metody izmereniya okeanograficheskikh parametrov) edited by I.V. Kireyev is a compilation of reports describing developments in radar, optical, and ultrasonic methods of measuring ocean parameters. It presents theoretical fundamentals and design principles and presents experimental data. The book provides an insight into the direction of Soviet remote sensing research.

A translation has been published as USSR REPORT: EARTH SCIENCES (UES-86-028-L).

### **CLIMATOLOGY**

The 1986 book "Climate Sensitivity" (Chuvstvitelnost klimata) by K. Ya. Vinnikov is based on a century of hydrometeorological observations and recent data, providing generalizations on empirical studies of climatic change. The link between global and regional climatic variation is discussed, and methods of determining climate system sensitivity (including reactions to fluctuations in carbon dioxide levels) are presented.

The annotation appears in USSR REPORT: EARTH SCIENCES (UES-86-025-L).

Beverly C. X2723

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## **HUNGARY: FALTERING MICROELECTRONICS INDUSTRY**

The Hungarian microelectronics industry's inability to recover from the destructive Microelectronics Enterprise (MEV) fire has called into question the technical and economic viability of this industry, according to a 22 December NEPSZABADSAG interview with MEV director Dr. Bela Balogh. (For previous reporting on Hungary's failure to revitalize its microelectronics industry, see SCIENCE AND TECHNOLOGY PERSPECTIVES Vol. 1, No. 13 p 10.)

Balogh observed that the MEV fire has forced Hungary to import (from other Bloc countries) wafers and chips to continue production of its own ICs at smaller microelectronics plants. The importation of wafers and chips is five times more expensive than production of these materials by MEV. Limited availability of materials and extensive quality control testing have restricted and frequently interrupted component production.

The MEV director also noted that overhead and production costs have become prohibitive. Minimal revenue from IC sales coupled with major capital expenditures to maintain production lines have drained away funds needed to expand manufacturing facilities and replace obsolete equipment.

Balogh concluded that Hungary's industrial policy must emphasize the revitalization of the microelectronics industry as a means of strengthening the country's industrial base. To this end, the Hungarian Government is seeking foreign (not further identified) financing and technology for a new MEV facility, probably to be built in the northern Pest area.

Sari P. X2907

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***PREVIEWS***

*PREVIEWS is an annotated list of selected science and technology items being translated by FBIS. The list may also contain previously published items of wide consumer interest.*

**CHINA REPORT: SCIENCE AND TECHNOLOGY**

**GOALS SET FOR SEVENTH FIVE-YEAR COMPUTER PLAN**

Article discusses Chinese goal of finalizing national standards equivalent to the OSI (open systems interconnection) protocol and of developing microprocessors that interface with IBM mainframes, DEC VAX minicomputers, and State-preferred microcomputers. (JISUANJI SHIJIE No. 19, 8 Oct 86)

**MICROCOMPUTER ASSEMBLY LINE ESTABLISHED IN SHANGHAI**

Using imported machinery, the Shanghai Computer Plant has built a microcomputer assembly line that is designed to manufacture 10,000 microcomputers a year. The technology and operation of the manufacturing equipment are discussed. (JISUANJI SHIJIE No. 19, 8 Oct 86)

**EUROPE/LATIN AMERICA REPORT: SCIENCE AND TECHNOLOGY**

**BRAZILIAN R&D ON ROBOT SERVOMOTORS**

Article discusses Brazilian R&D on servomotors for robots in an effort to decrease Brazil's dependence on foreign suppliers of factory automation equipment. (Sao Paulo MAQUINAS E METAIS, Jul 86)

**EC 1982-86 BIOTECHNOLOGY PROGRAMS**

Article examines progress made by the EC Biomolecular Engineering Program for the period 1982-86 in the areas of agriculture, stock-farming, and second generation bioreactors. (Milan BIOTEC Apr 86)

**FACTORY AUTOMATION SEMINARS SHOW BRAZILIAN TECHNICAL SOPHISTICATION**

Article details agendas of the Sixth Brazilian Seminar on Numerical Control, the Second International Fair on Industrial Automation, and the Third Expocon. (Sao Paulo MAQUINAS E METAIS Jul 86)

**FRANCE'S RHONE-POULENC DEVELOPING CERAMICS**

Article examines Rhone-Poulenc's high-tech venture, Ceramiques et Composites (C&C), which will conduct liquid crystal and ceramics R&D. (Paris L'USINE NOUVELLE Supplement to No. 51, 18 Dec 86)

**EXPERT SYSTEM TO MANAGE ALUMINUM PRODUCTION**

Article details the use of Totem, Europe's largest expert system, at the aluminum manufacturing facilities of Pechiney-Cegedur. Using a minimum of 7,000 rules, Totem currently directs the production of heavy aluminum sheet, most of which is used for Airbus structural parts. In 1987 Totem will begin managing all the factory's production lines, including foundry, extrusion, and thin sheet. (Paris L'USINE NOUVELLE 18-25 Dec 86)

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**EUREKA STOCKHOLM CONFERENCE: 37 NEW PROJECTS, CALL FOR STANDARDIZATION**

Article discusses the Netherlands' doubled budget for Eureka projects. At the Eureka conference in Stockholm, 37 new projects were approved, 14 of which have Dutch participation. Article also notes that major European industries are calling for European standards. (Amsterdam COMPUTABLE 2 Jan 87)

**EEC ADOPTING REGULATIONS TO FACILITATE HIGH-TECH INVESTMENT**

The article describes suggestions made by the European Commission to mobilize equity capital for high technology and large-scale infrastructure projects. Emphasis is placed on stimulating venture capital and establishing investment companies which would work within a publicly funded guarantee scheme called "Eurotech Insur." (Brussels EEC INFORMATION MEMO No. P(86)96 Dec 86)

**ESPRIT PROGRESS REPORT SUBMITTED**

Although only three years old, ESPRIT has already assembled 2,900 researchers working on 201 separate projects. The article presents five examples of ESPRIT projects that have made significant contributions to Europe's industrial competitiveness. (Brussels EEC INFORMATION MEMO No. P-98 Dec 86)

**WORLDWIDE REPORT: TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT**

**EI DIGITEL EXCHANGES FOR ITALIAN SWITCHING SYSTEM**

Article discusses Ei Digitel—a newly created joint venture between Itacom and Yugoslavia's Elektronska Industrija Nis—manufacture (in Yugoslavia) of exchanges for use in the Yugoslavian telecommunications system. (Milan AUTOMAZIONE E STRUMENTAZIONE May 86)



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